

COMPUTED TOMOGRAPHY

DEFINITION OF TERMS

Air calibration – scan of air in gantry; based on a known value of -1000 for air, the scanner calibrates itself according to this density value relative to actual density value measured.

Algorithm – mathematics formula designed for computers to **carry out complex calculation** required for image reconstruction; designed for enhancement of soft tissue, bone and edge resolution. **Also referred to as KERNEL**

Anisotropic spatial resolution – spatial resolution of a voxel in which all three axes of voxel element are not equal. **Slice thickness is not equal to pixel size.**

Aperture – opening of the gantry through which patient passes during scan

Archiving – storage of CT images on long term storage device such as cassette tape, magnetic tape and optical disk.

Artefact – distortion or error in image that is unrelated to subject being studied.

Attenuation – coefficient CT numbers assigned to measure remnant radiation intensity after attenuation by tissue density

Axial – describes plane of image as presented by CT scan; same as transverse.

Bolus – preset amount of radiopaque contrast medium injected rapidly per IV administration to visualize high flow vascular structure, usually in conjunction with dynamic scan; most often injected using a pressure injector.

Channel – in multidetector CT, multiple rows of detector assembly rotating

Computed Tomography (CT) – x-ray tube detector assembly rotating 360 degrees around specified areas of the body; also called CAT (computed axial tomography) scan

CT angiography – use of volumetric CT scanning with spiral technique to acquire image data that are constructed into 3 dimensional CT angiograms

CT number – arbitrary number assigned by computer to indicate relative density of a given tissue: CT number varies proportionately with tissue density: high CT numbers indicate dense tissue, and low CT numbers indicate less dense tissue. All CT numbers are based on the density of water, which is assigned a CT number of 0. **Also referred to as Hounsfield Unit**

Contrast resolution – ability to differentiate between small differences in density within the image

Curved planar reformations – post processing technique applied to stacks of axial image data that can be constructed into irregular or oblique planes

Data Acquisition System (DAS) – part of detector assembly that converts analog signal to digital signals that can be used by the CT computer

Detector – electronic component used for radiation detection; made of either high density photo reactive crystals or pressurized stable gases

Detector assembly – electronic component of CT scanner that measures the remnant radiation exiting the patient, converting the radiation to an analog signal proportionate to the radiation intensity measured

Direct coronal – describes position use to obtain images in coronal plane; used for head scans to provide images at the right angle to axial images.

Dose length product (DLP) – commonly reported dose descriptor on CT scanners.

Dynamic scanning – process by which raw data are obtained by continuous scanning; images are not reconstructed but are saved for later reconstruction; most often used for visualization of high flow of vascular structures; can be use to scan a uncooperative patient rapidly.

Field of view (FOV) – area of anatomy displayed on the monitor; can be adjusted to include the entire body section or a specific part of the patient anatomy being scanned.

Gantry – part of CT scanner that houses x-ray tube, cooling system, detector assembly and DAS; often referred to as the “doughnut” by patients

Generation – description of significant levels of technologic development of CT scanners; specifically related to tube/detector movement

Gray-scale image – analog image whereby **each pixel** in the image corresponds to particular **shades of gray**

Helical CT – **data acquisition method** that combines continuous **gantry rotation with continuous table movement to form a helical path** of scan data; **also called spiral CT**.

High resolution scans – use of scanning parameters that **enhance contrast resolution of an image**, such as thin slices, high matrices, high spatial frequency algorithms and small display FOV

Host computer – **primary link between system operator and other components of imaging system**

Hounsfield units (HU) – **number used to describe average density of tissue**; term is used interchangeably with CT number; named in honor of **Hounsfield**, who is generally given credit for development of the **first clinically viable CT scanner**

Image misregistration – **image distortion** caused by combination of table indexing and respiration

Index – **table movement**; also referred to as table increments

Isotropic spatial resolution – **spatial resolution of a voxel** in which all three axes of the volume element are equal. **Slice thickness is equal to pixel size**.

Mapping – assignment of **appropriate gray level to each pixel in an image**.

Matrix – mathematical formula for calculation made up of **individual cells for number assignment**; CT matrix stores a CT number relative to the tissue density at that location

Maximum intensity projection (MIP) – **reconstruction of brightness pixels from stack of image data into a 3D image**

Multiplanar reconstruction (MPR) – **post processing technique** applied to **stacks of axial image data** that can be reconstructed into other orientations or imaging planes.

Multiple scan average dose (MSAD) – **dose descriptor** that calculates dose resulting from a **series of scans over an interval length of scans**

Noise – random variations of CT numbers around some mean value within a uniform object; **noise produces a grainy appearance in the image**.

Partial volume averaging – **calculated linear attenuation coefficient** for a pixel that is weighted average of all densities in the pixel

Pixel (picture element) – **one individual cell surface** within an image matrix used for image display

Post processing techniques – **specialized reconstruction techniques** that are applied to **CT images to display the anatomic structures from different perspective**

Primary data – **CT number assigned to the matrix by the computer**; the information required reconstructing an image

Protocol – **instruction for CT examination** specifying **slice thickness, table increments, contrast administration, scan diameter, and any other requirements specified by the radiologist**.

Quantum noise – **any noise in the image that is a result of random variation** in the number of x-ray photons detected

Real time – **ability to process or reconstruct incoming data in milliseconds**

Reconstruction – **process of creating a digital image from raw data**

Region of interest (ROI) – **measurement of CT** within a specified area for evaluation of average tissue density

Rendering – **process of changing the shading of a 3D image**; commonly used to increase depth perception of an image

Retrieval – **reconstruction of images stored on long term device**; can be done for extra film copies or when films are lost

Scan – actual rotation of x-ray tube around the patient; used as generic reference to one slice or an entire examination.

Scan diameter – also referred to as the **zoom or focal plane of a CT scan**; predetermined by the radiographer to include the anatomic area of interest; determines FOV

Scan duration – amount of time **used to scan an entire volume during a single spiral scan**

Scan time – x-ray exposure time in seconds

Segmentation – **methods of cropping or editing** target objects from image data

Shaded surface display (SSD) – processed **used to generate 3D images** that show the surface of a 3D object

Shading – post processing technique used in 3D reconstruction **to separate tissues of interest by applying a threshold value to isolate the structure of interest**

Slice – **one scan through a selected body part**; also referred to as a **cut**; slice thickness vary from **0.35mm to 1 cm**, depending on the examination

Slip ring – low voltage electrical contacts within the gantry designed to allow continuous rotation of an x-ray tube without the use of cables connecting internal and external components

Spatial resolution – **ability to identify visibly anatomic structures** and small objects of **high contrast**

Spiral CT – scanning method that combines a **continuous gantry rotation with a continuous table movement** to form a spiral path of scan data; **also called helical CT**

Streak artifacts – **artifacts created by high density objects** that result in an **arc of straight lines** projecting across the FOV from a common point.

System noise – **inherent property of a CT scanner**; the difference between the measured CT number of a given tissue and the known value for that tissue; **most often evaluated through the use of water phantom scans**

Table increments – specific amount of **table travel between scans**; can be varied to move at any specified increment; most protocols specify from **1mm to 20 cm**, depending on type of examination; **also referred to as indexing.**

Table speed – **longitudinal distance travelled by the table** during one revolution of the x-ray tube

Temporal resolution – **ability of CT system to freeze motion of the scanned object**; the shortest amount time needed to acquire a complete data set.

Threshold value – **CT number used in defining the corresponding anatomy** that comprises a 3D object

Useful patient dose – **radiation dose received by the patient** that is actually and converted into an image

Voxel (volume element) – individual pixel with the associated **volume of tissue based on the slice thickness**

Window – arbitrary numbers used for image display based on **various shades of gray**; **window width** controls the overall gray level and affects image contrast; **window level** (center) control subtle gray images within a certain width range and ultimately affects the brightness and overall density of an images